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ONE PIECE STAMPED COMPRESSIBLE SPRING PIN

Field of Invention

The present invention relates to pins for establishing electronic connections, and more specifically for compressible spring pins used in establishing repeatable electronic connections.

Background of the Invention

Compressible spring pins are used as electrical contacts in many industrial and electronic applications. These pins are required to have a long lifetime, and a safe and consistent contact performance. There are many electronic devices, such as ATE used for testing flash memories which require thousands of pins, and as use and complexity of electronic circuitry proliferates, the demand for pins of this type are substantially increasing. A conventional spring pin requires a barrel which houses a spring and plunger, as well as (in some instances) a retainer plug. These pieces are individually machined, plated (usually gold)

and then assembled. As a result of the nature of its design and manufacturing processes, the end product is quite expensive.

In particular, there is a need for a compressible spring pin which can be manufactured at low cost, with adequate functional performance to meet most of industries mechanical and electrical requirements. The present invention satisfies these and other needs, as set forth in the following description

Summary of the Invention

In accordance with one aspect of the invention, a one piece compressible spring pin is formed from a single piece of sheet metal. A predetermined shape is stamped from the piece of sheet metal and formed into the spring pin. The spring pin comprises a center pin surrounded by outer shells and a base, all integrally formed from the sheet metal. The center pin is rippled with a multiplicity of waves to impart spring characteristics to the pin.

In accordance with a further embodiment, the center pin is comprised of a contact point and a cylindrical portion at an end away from the base. The contact point and the base may be selectively plated.

These and other aspects, features, steps and advantages can be further appreciated from the accompanying drawing Figures and description of certain illustrative embodiments.

Brief Description of the Drawing Figures

Figures 1A and 1B are perspective views of a one-piece stamped, compressible spring pin in accordance with an embodiment of the invention shown in different stages of closing done by the die;

Figure 1C is an exploded perspective view of the spring pin show in Fig. 1A;

Figures 2A-2C are plan views of the spring pin shown in Fig. 1A, at different stages of the manufacturing process; and

Figures 3A-3F are side elevation views of the spring pin shown in Fig. 1A, at different stages of the manufacturing process.

Detailed Description of the Illustrative Embodiments

The present invention relates to a one-piece stamped, compressible spring pin. According to one embodiment of the present invention, as shown in Figures 1A-1C, the spring pin 10 is formed from a single piece of resilient sheet metal and comprises conductive outer shells 20, 22, a pin 30, and base 36. The pin 30 is comprised of a contact point 32, and a central portion 34 between the base 36 and the contact point. The spring pin includes a cylindrical portion 31 adjacent to the contact point 32, and a rippled segment 34 between the cylindrical portion and the base 36. The rippled segment 34 imparts spring characteristics to the pin 30.

Because the spring pin 10 is formed from a single piece of sheet metal, all components are integrally formed during the stamping process. The material from which the spring pin of the present invention is formed can be a resilient sheet metal (such as beryllium

copper or phosphor bronze) or any other conductive material that can be stamped and formed into spring pin 10.

The spring pin of the present invention is formed by a progressive stamping process in which areas of the sheet metal are removed, and then selected portions are bent at successive forming stations. Each forming station consists of suitable punches and dies to result in the arrangement shown and described herein.

The stamped spring pin 10, as depicted in Figure 2A, is cut out of a single sheet of metal utilizing a stamping process. The stamping process cuts a central area 136 having two stamped wings 120, 122 extending from opposite sides, and a substantially orthogonal extension 130, which extends from an edge of the central area 136 midway between the two wings 120, 122. At an end of the orthogonal extension 130 away from the central area 136, is a broadened flap 144.

Figure 2B depicts the spring pin after the broadened flap 144 has been rolled together to form both the contact point 32 and the adjacent cylindrical portion 31 of pin 30. A portion of orthogonal extension 130 is transformed, by a bending process, into a multiplicity of waves to create rippled segment 34, as depicted in Figure 3D. These waves impart spring characteristics to the pin 30. Figure 2C is a top plan view of spring pin 10, as depicted in the elevation view of Figure 3D.

Figures 3A through Figure 3C depict, in elevational view, the spring pin of the present invention in successive stages of the progressive stamp and die process used to manufacture the pin. Figure 3A depicts the stamped spring pin 10 after orthogonal extension

130 is bent perpendicular to central area 136. Also shown in Figure 3A are outer edge portions 160, 162 of the stamped wings 120, 122. Figure 3B shows the outer edge portions 160, 162 bent upwards to begin the formation of the conductive outer shells 20, 22. Referring to Figure 3C, the stamped wings 120, 122 are bent to fully define the outer shells from the base 36. After the outer shells 20, 22 are completely formed, as described below, the shells are bent to close around the pin 30 as illustrated in Figures 3E and 3F (front and side elevation views, respectively).

With reference to Figures 1A through 1C, the conductive outer shells 20, 22 are cup-shaped. The outer shells 20, 22 are drawn into a cup-shape during the progressive die process, which uses sequential sets of punches and dies. The manufacture of a cup-shape from a single piece of flat sheet metal, as disclosed herein to form the conductive outer shells 20, 22, is well known in the art of progressive stamp and die processes.

The one-piece stamped, compressible spring pin 10 of the present invention can be plated with a material to enhance its conductivity. Alternatively, particular regions of the spring pin, e.g., the outer surface of base 36 and the tip of contact point 32 may be selectively plated.

Thus, while there have been shown, described, and pointed out fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions, substitutions, and changes in the form and details of the devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit and scope of the invention. For example, it is expressly intended that all combinations of those elements steps which perform substantially the same, function in substantially the same way, to

achieve the same results are within the scope of the invention. Substitutions of elements from one described embodiment to another are also fully intended and contemplated. It is also to be understood that the drawings are not necessarily drawn to scale, but that they are merely conceptual in nature. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.